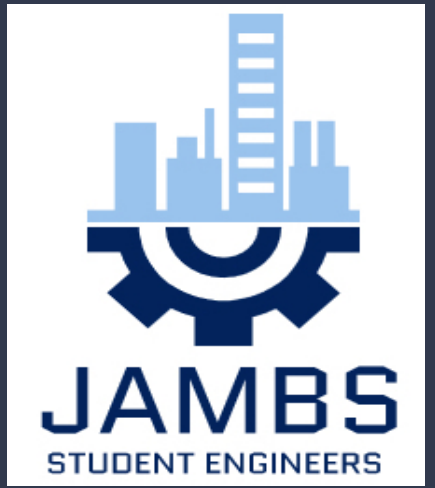
Orrington Industrial Park

JAMBS Student Engineers

Brody Campbell (PM), James Costigan, Morgan Cram,
Andrew Kurmin, and Sean Mackintosh



UMaine Capstone Requirements

The goal of a capstone project is to prepare students with a major design experience that is a culmination of previous course work and incorporates engineering standards and realistic constraints.

- Design in 3 of the 5 civil engineering subdisciplines (transportation, water resources, geotechnical).
- Engineering designs are to consider sustainable development, political/social considerations, and monetary constraints

Project Disclaimer

The materials contained in this presentation were developed by us as students as part of our education in the College of Engineering in order to gain supervised engineering problem-solving experience. Therefore, information and recommendations, while useful for understanding a particular project's scope and possibilities for implementing solutions, should not be relied upon solely for the purposes of advancing a project beyond conceptual levels.

Furthermore, such material should not substitute for or replace the services of a design professional practicing in the areas of engineering or architecture, particularly for projects whose direct or indirect impact may affect the safety, health, or welfare of the public.

In providing you with this information, our intention is to uphold and enhance the honor, integrity, and dignity of the engineering profession. We thank you for the opportunity to develop our skills through our work on this project.

Presentation Overview

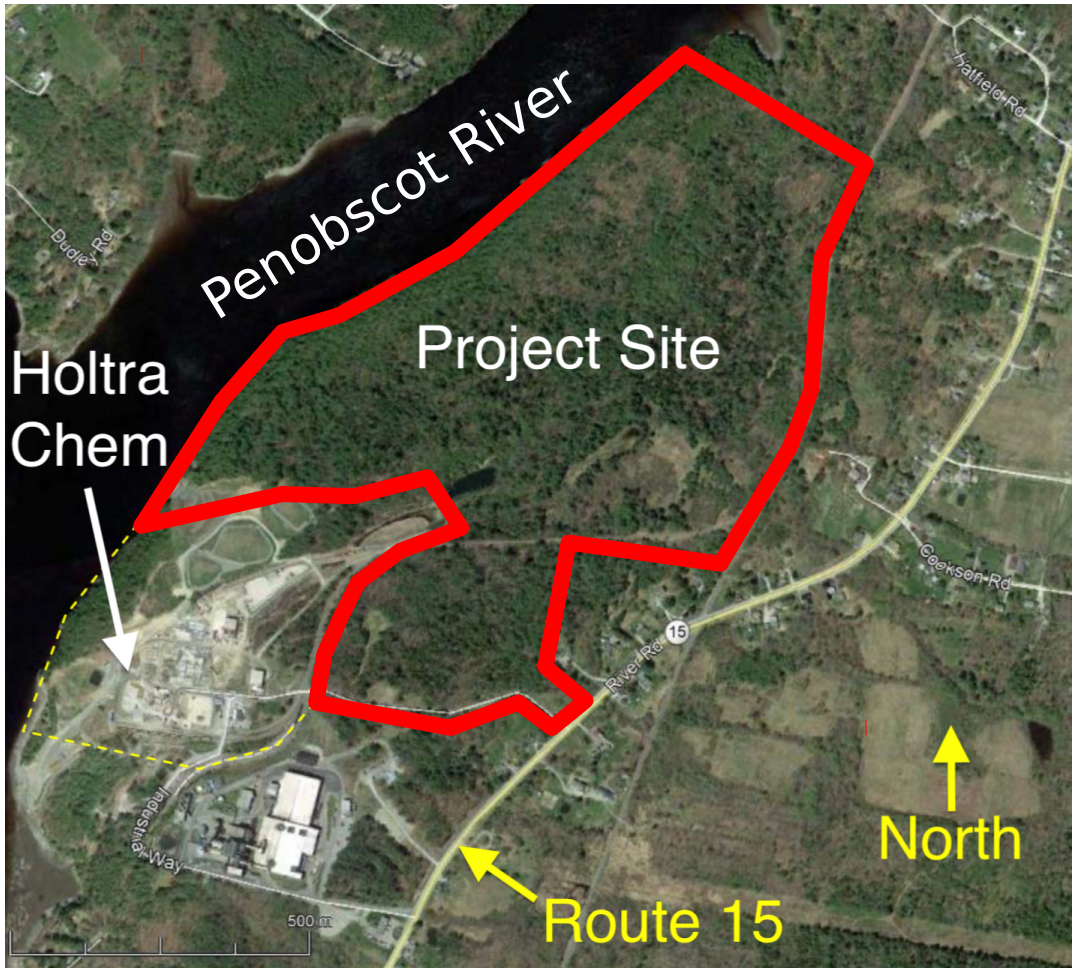
- Project Overview
- Site Restrictions
- Design Alternatives
- Roadway Alignment
- Roadway Material Profile
- Water System
- Sewer System
- Stormwater Management System
- Railroad Spur
- Cost Analysis
- Engineer’s Opinion of Cost
- Project Summary

Project Overview

Background
- 163 acre site
- Located in Orrington, ME
- Borders the Penobscot River

Project Scope
- Infrastructure to support industrial buildings
- Environmental impact

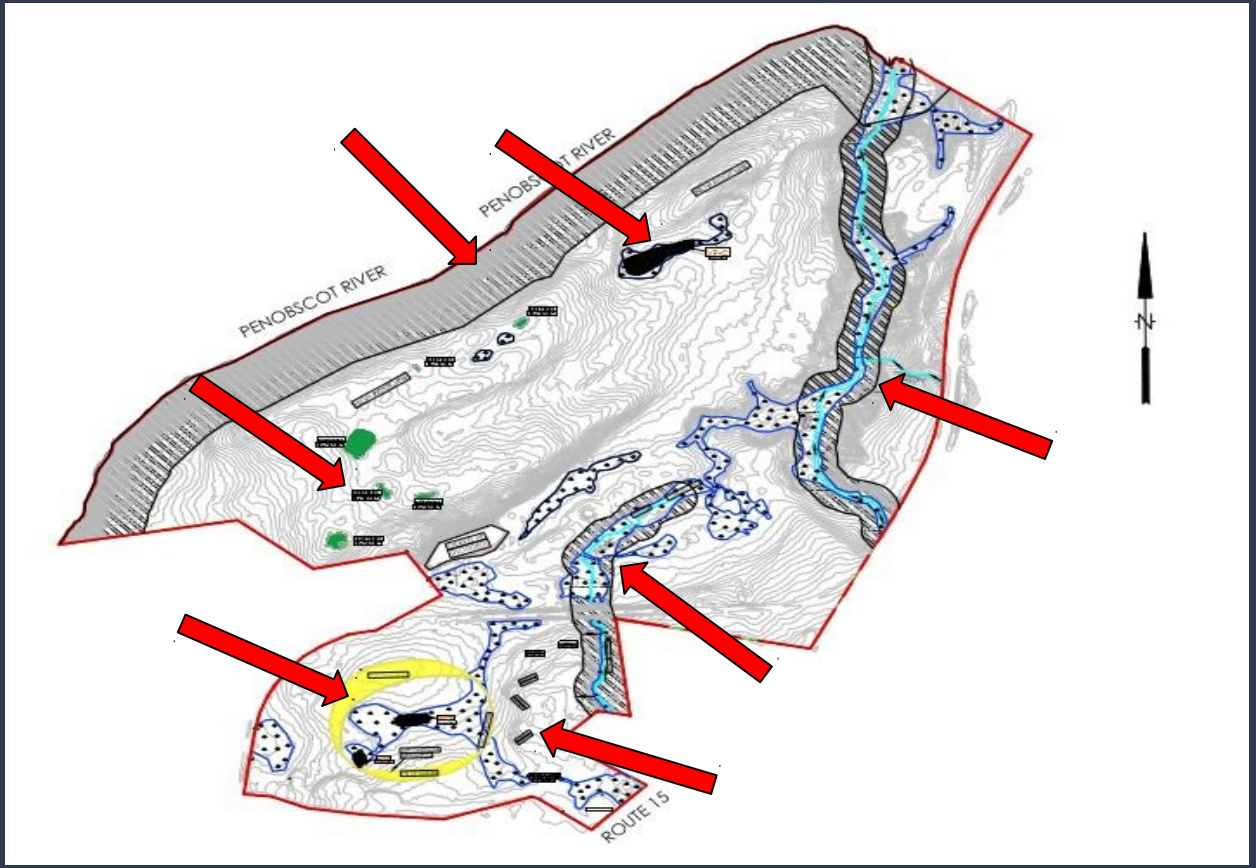
Design Alternatives
- Recreational space
- Pedestrian access
- Roadway design life



Google maps edited by JAMBS SE

Site Restrictions

- Vernal pools
- Bedrock outcrops
- Wetlands & river setbacks



Map provided by MES and altered by JAMBS SE

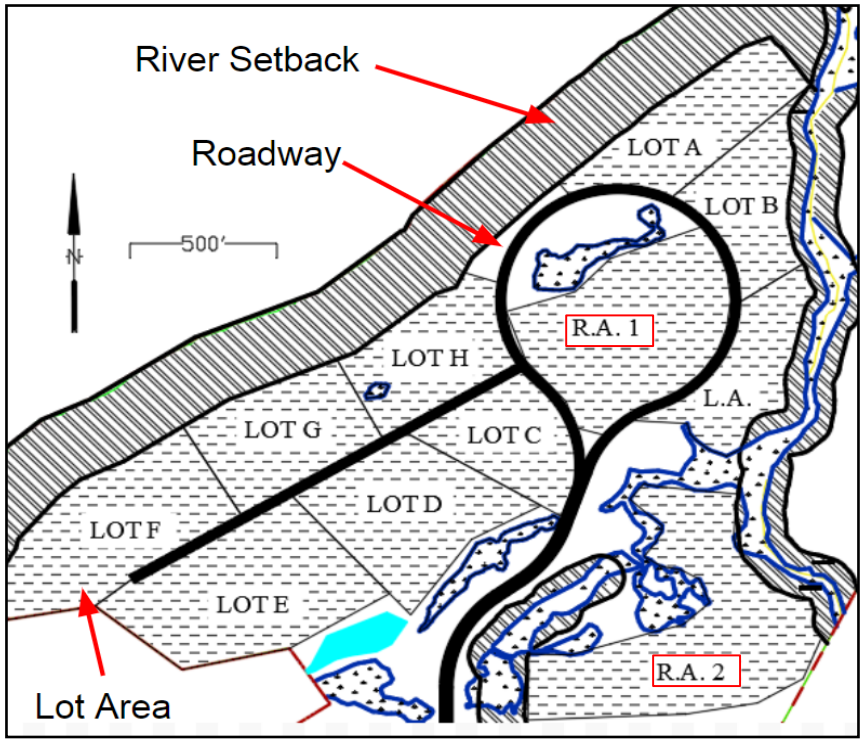
Design Alternatives and Roadway Alignment

Presented by Sean Mackintosh

Design Alternatives

Option A

- Pedestrian access
- Recreational space
- Roadway material profile
- Stormwater management

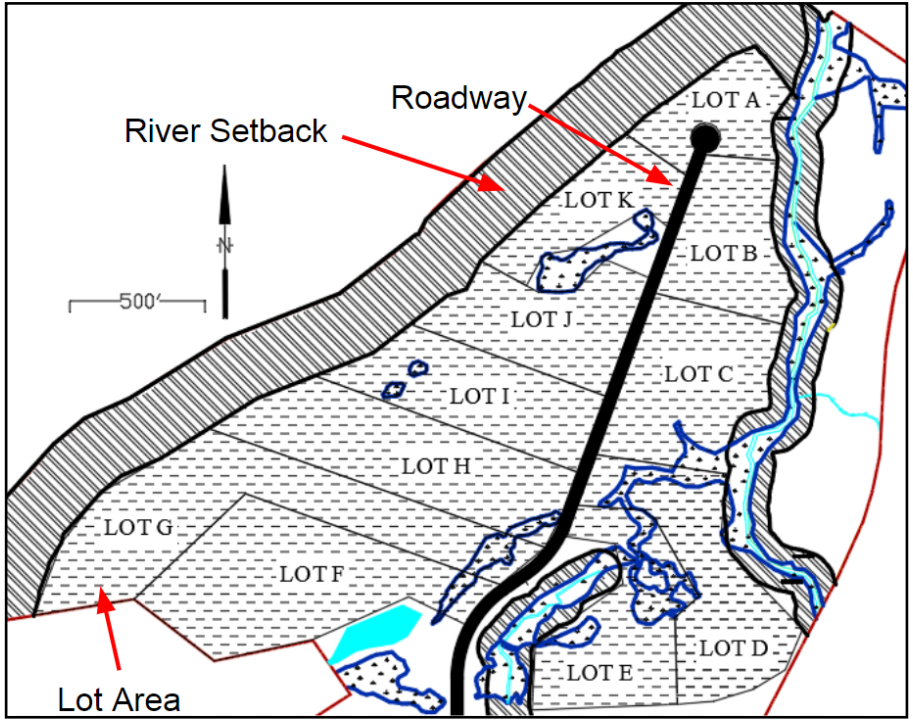


Map provided by MES and altered by

Design Alternatives

Option B

- No pedestrian access
- No recreational space
- Roadway material profile
- Stormwater management



Map provided by MES and altered by JAMBS SE

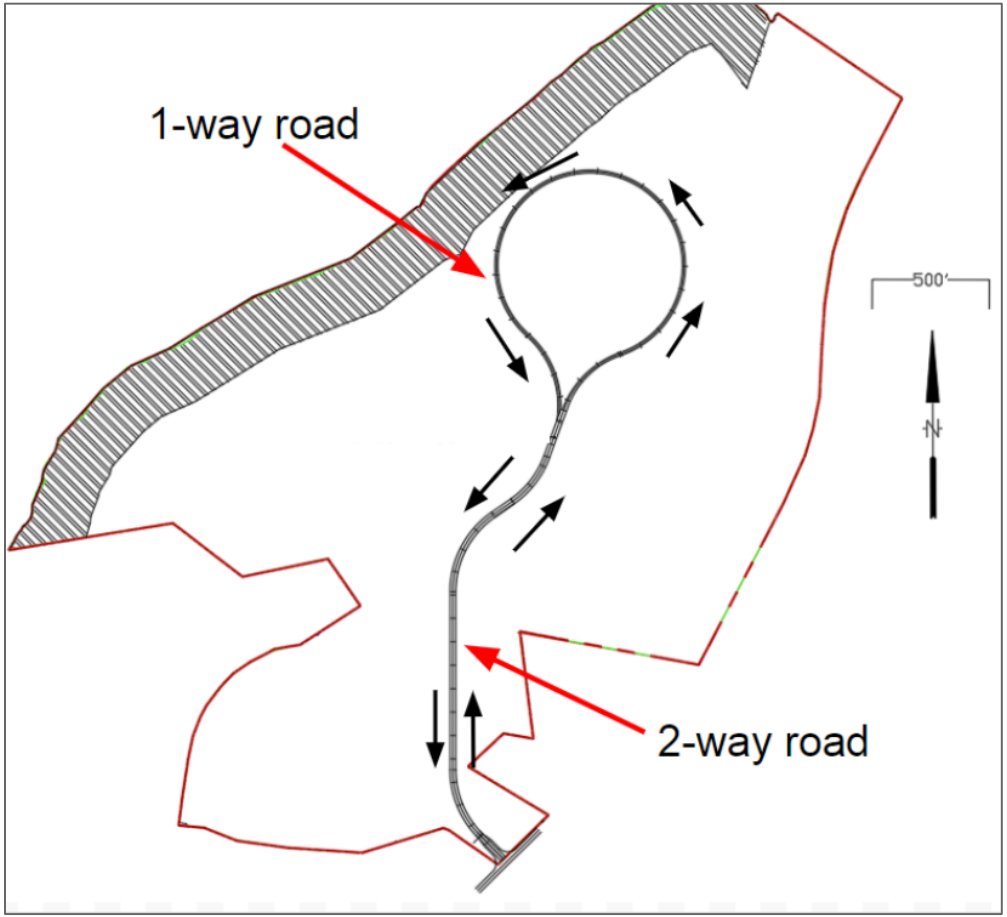
Roadway Alignment

Factors considered:

- Horizontal & vertical alignments
- Appropriate speed limits
- Industrial sized vehicle
- Overall safety

Major results:

- 25 mph speed limit (30 mph design speed)
- 400 ft. radius turns
- 2% grade
- Over 5,000 ft.

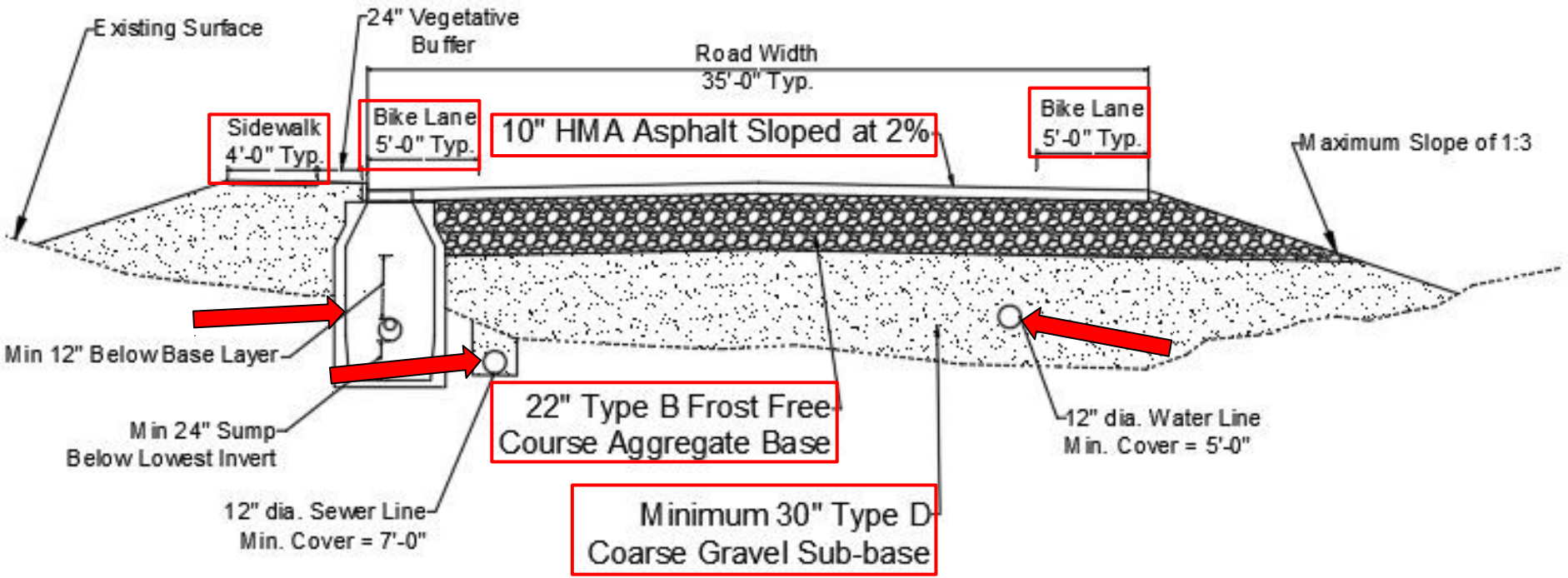


Map provided by MES and altered by IAMBS SE

Roadway Material Profile

Presented by Morgan Cram

Roadway Material Profile



Roadway Material Profile

12 year design life

Layer	Thickness (inches)
Hot Mix Asphalt (HMA)	7”
Base	6”
Subbase	24”

50 year design life

Layer	Thickness (inches)
Hot Mix Asphalt (HMA)	10”
Base	22”
Subbase	30”

Utilities

Presented by Brody Campbell and James Costigan

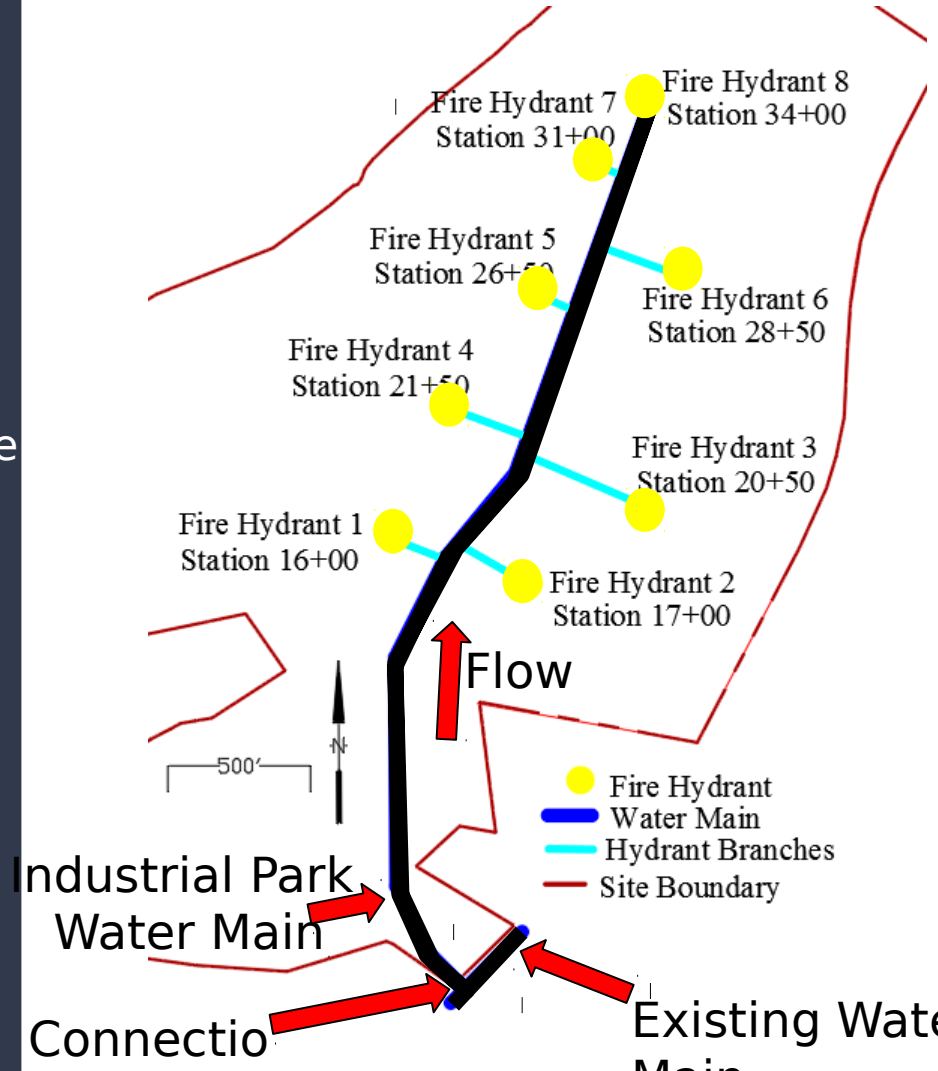
Water System

Factors considered:

- Pipe network
- Connection to municipal line
- Sprinkler systems

Major results:

- Maximum flow: 2500 gpm
- 3,420 ft. 12 in. DIP
- 400 ft. 6 in. DIP
- 8 fire hydrants



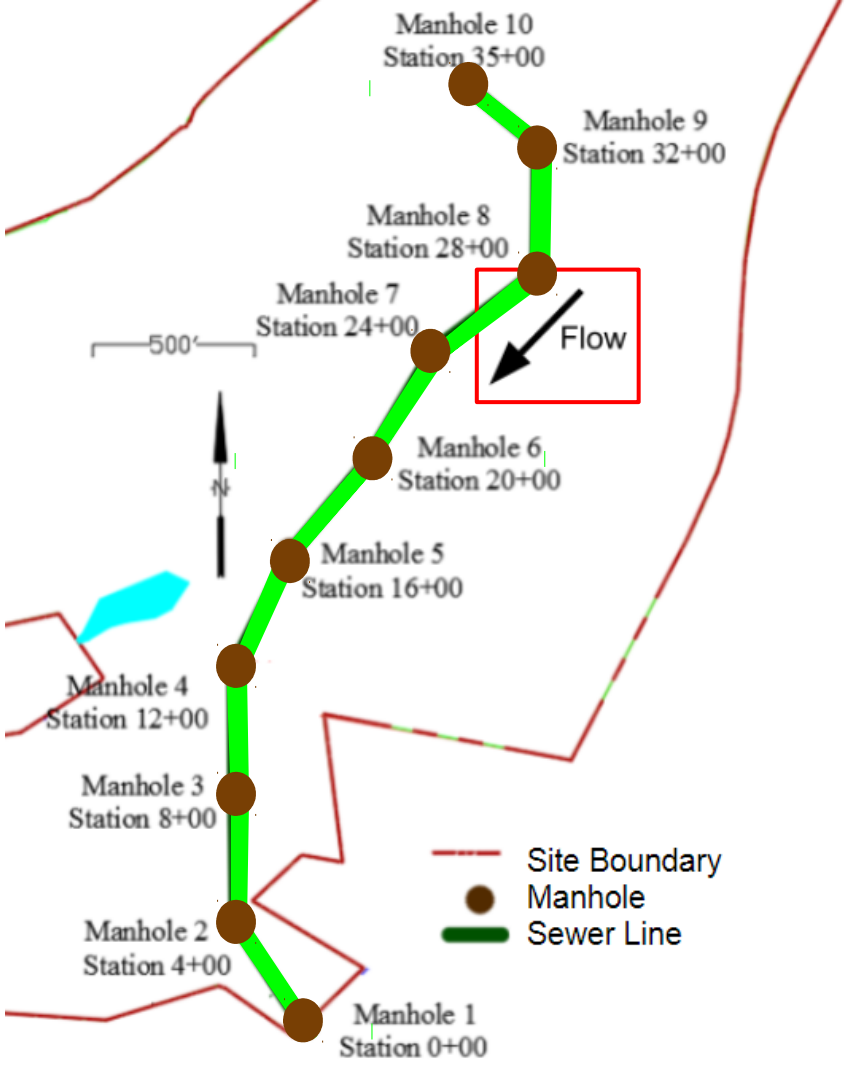
Sewer System

Factors considered:

- Pipe network
- Manhole locations
- Flow volume

Major results:

- Average flow: 295,000 gpm
- 1,466 ft. 8 in. PVC pipe
- 1,944 ft. 10 in. PVC pipe
- 10 precast manholes



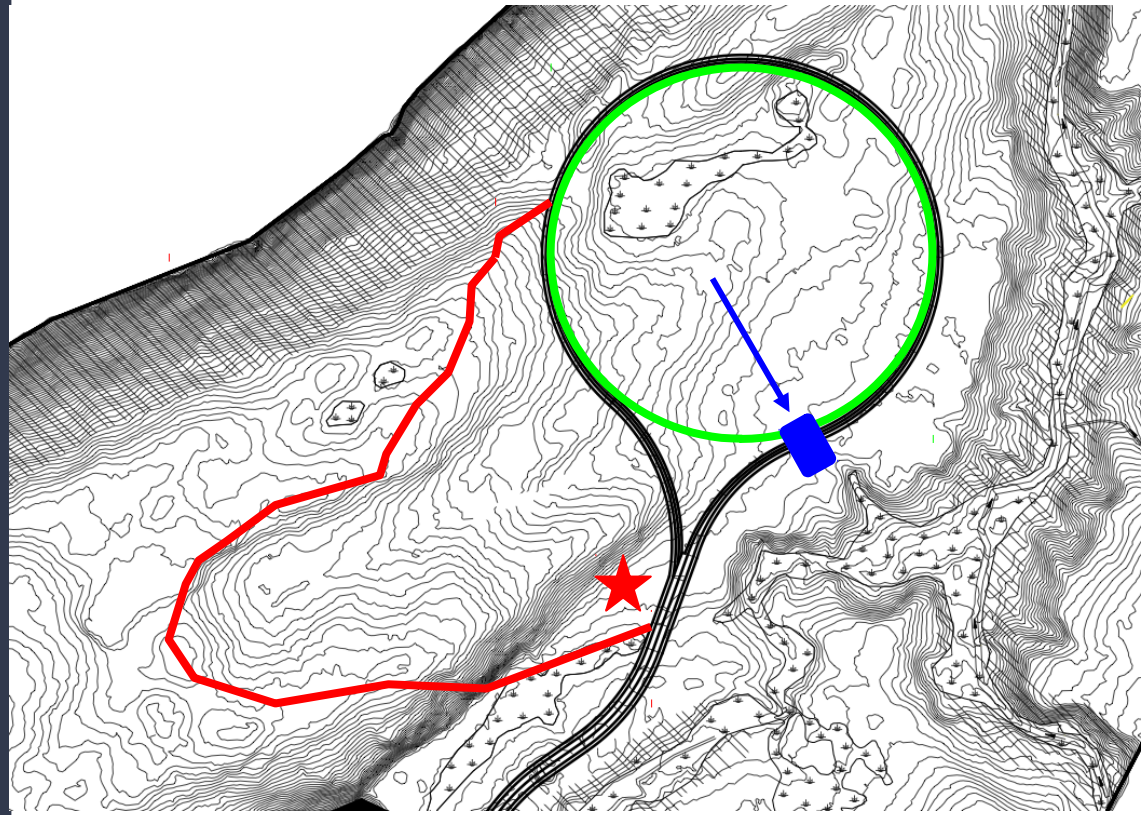
Stormwater Management

Factors considered:

- Hydrological analysis
- Catch basin and underdrain
- Retention pond analysis

Major results:

- 19 catch basins
- 704 ft. 6” Type C underdrain
- 4,152 ft. 12” Type C underdrain
- 110 ft. 18” Culvert and outflow
- 350,000 CF retention pond



Railroad Spur

Presented by James Costigan

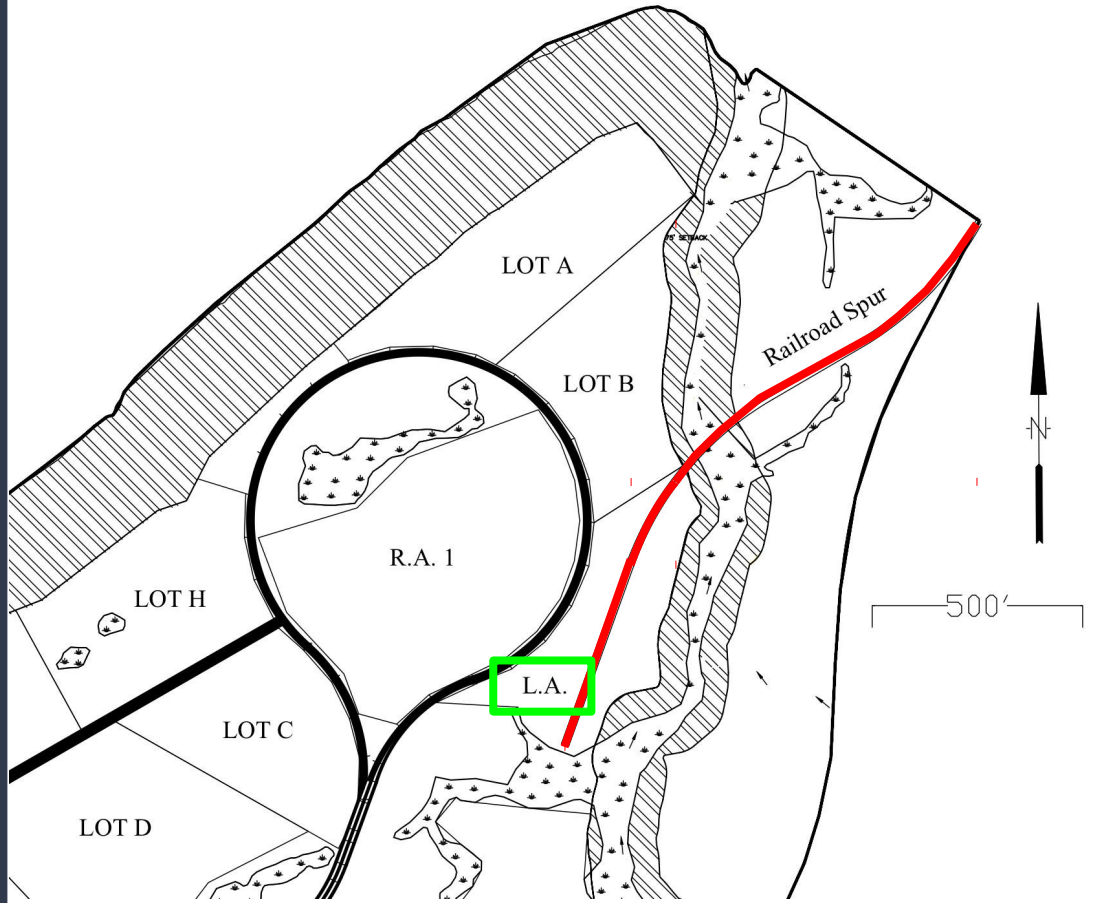
Railroad Spur

Factors considered:

- Turning radii
- Rail access
- Wetlands

Major results:

- 1,647 ft. length
- 765 ft. turning radii



Cost Analysis

Presented by Andrew Kurmin

Initial Cost Analysis

Methods:

- Average end area takeoff
- MaineDOT average bid item price

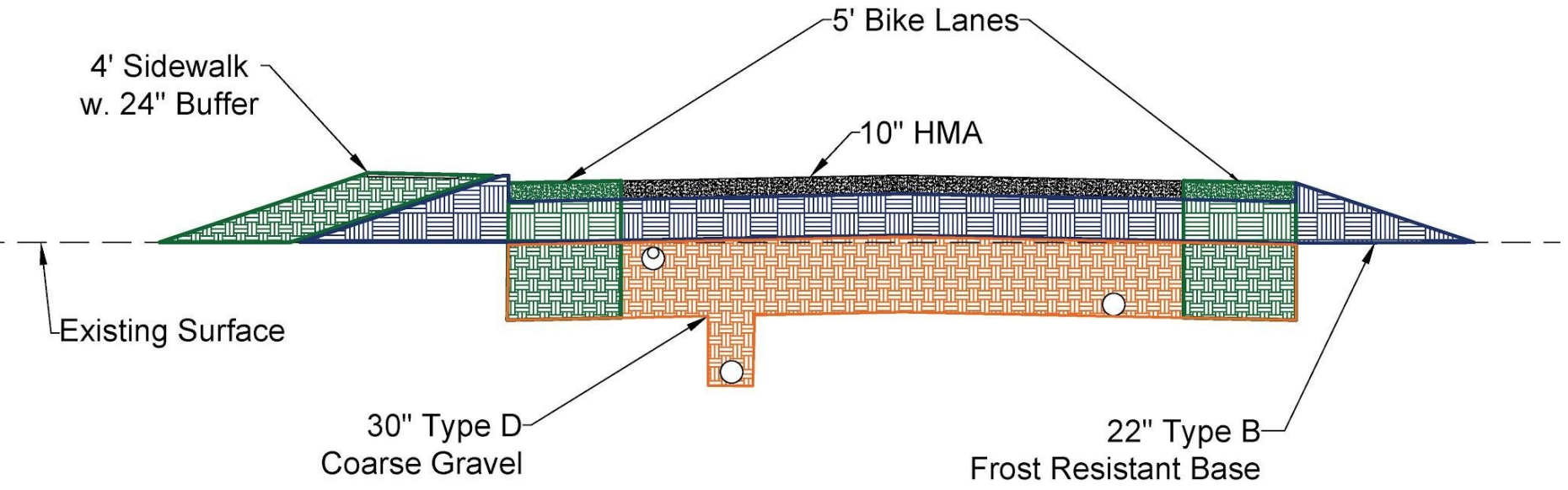
Exclusions from scope

- Railroad
- Permitting, engineering, and construction management
- Connection to existing sewer line

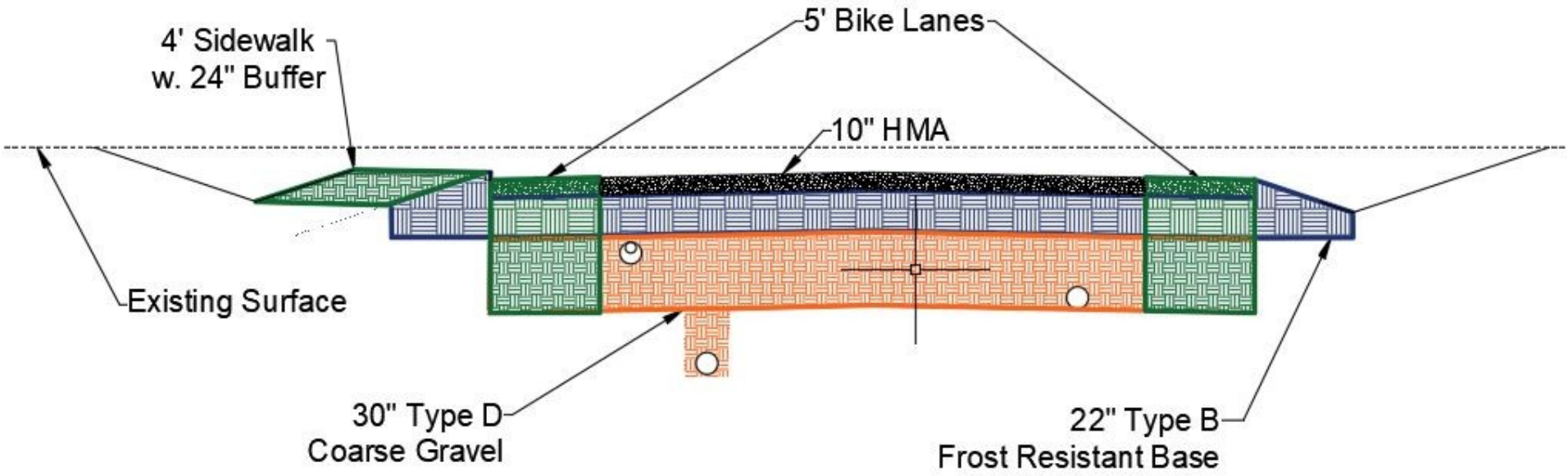
Item Description	Units	Unit Price	Takeoff Quantity	Total Cost
CLEARING	AC	$11,524	6	$69,144
*COMMON EXCAVATION	CY	$21.88	44,500	$973,660
*ROCK EXCAVATION	CY	$100.98	0	$0
CRUSHED STONE FILL	CY	$69.62	369	$25,690
NEW TRENCH EXCAVATION	CY	$21.67	7,180	$155,591
*AGGR SUBB COURSE - TYPE D	CY	$38.84	15,200	$590,368
AGGREGATE BASE COURSE - TYPE B	CY	$50.17	1,840	$92,313
HOT MIX ASPHALT 12.5 MM HMA SURFACE	T	$162.18	1,250	$202,725
60" CATCH BASIN TYPE B1	EA	$4,616	18	$83,100
MANHOLE	EA	$5,196	10	$51,961
HYDRANT ASSEMBLY (TEE/GATE VALVE)	EA	$7,250	6	$43,500
Grand Total:				$4,499,354

AC = acres
CY = cubic yards
T = tons
EA = each

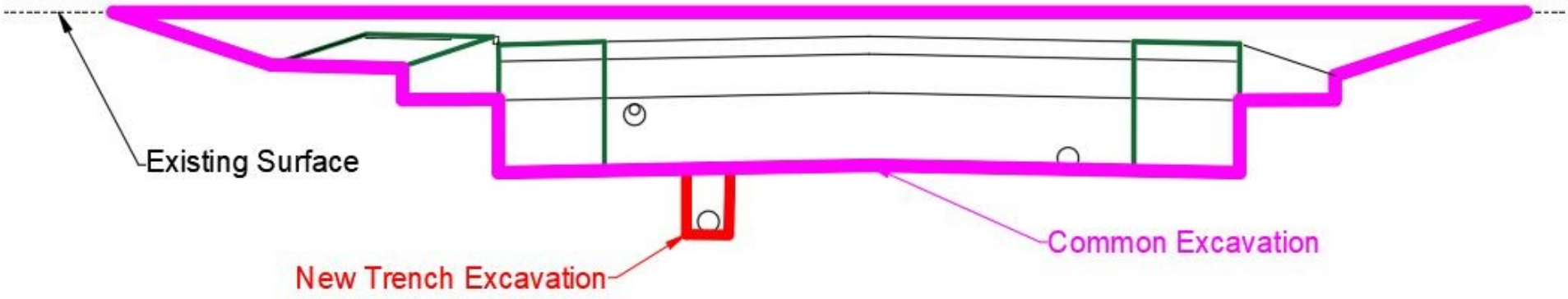
Roadway Fill



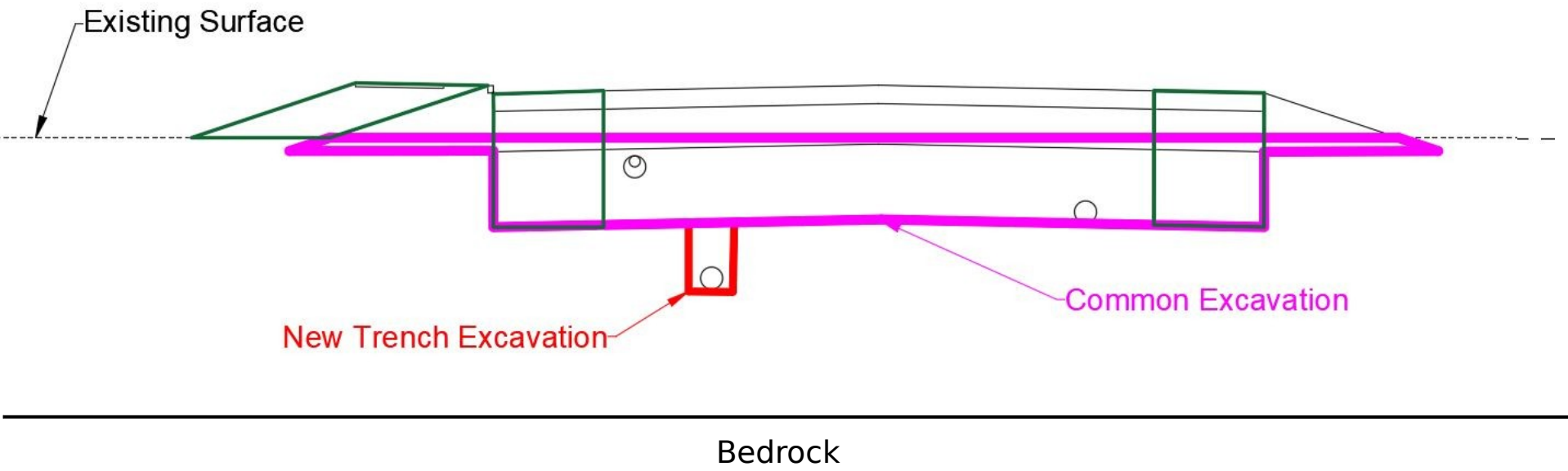
Roadway Fill (cut area)



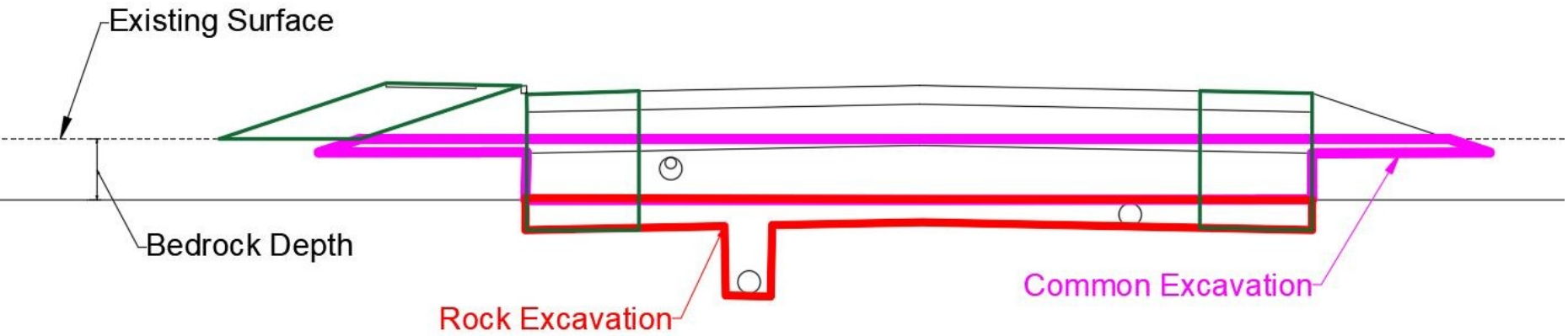
Roadway Excavation (cut area)



Roadway Excavation (fill area)



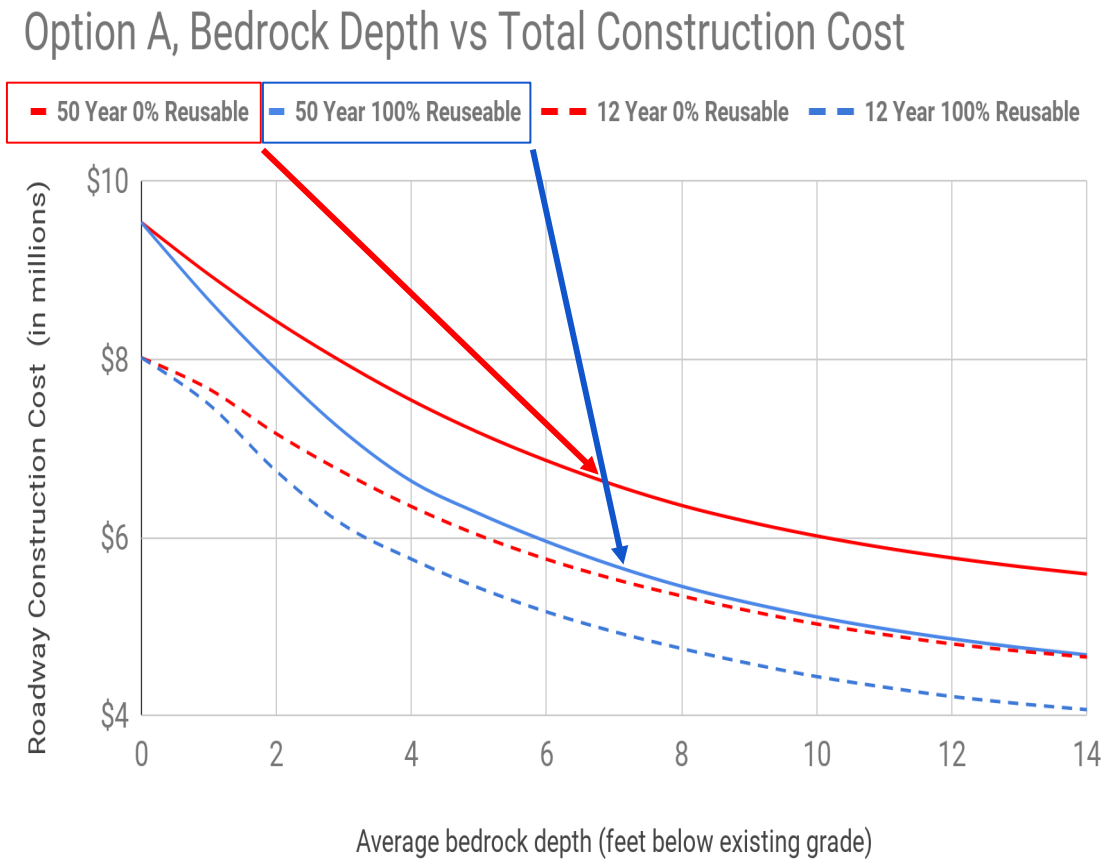
Bedrock


Existing Surface
Bedrock Depth
Rock Excavation
Common Excavation

Bedrock Sensitivity Analysis

Things to note:

- Cost is in millions
- Cost does NOT include pedestrian and railroad alternatives
- Cost does NOT include engineering and permitting fees



Long Term Cost Analysis

Factors Considered:

- Initial Cost (construction)
- Annual Costs (plowing and road maintenance)

Job	Cost Per 1000 ft ($)	Option B Total Cost ($)	Option A Total Cost ($)
Plowing (28 Storms)	$820	*$155,000	*$161,900
¾” Overlay	$44,000	$150,000	$220,000

*Based on 28 days of snow per year (NOAA)

¾” Overlay	12 Year Design	50 Year Design
Expected Life (years)	7	10

MaineDOT, 2019

Engineer's Opinion of Cost

Factors considered:

- Clearing and excavating
- Utilities
- Roadway construction

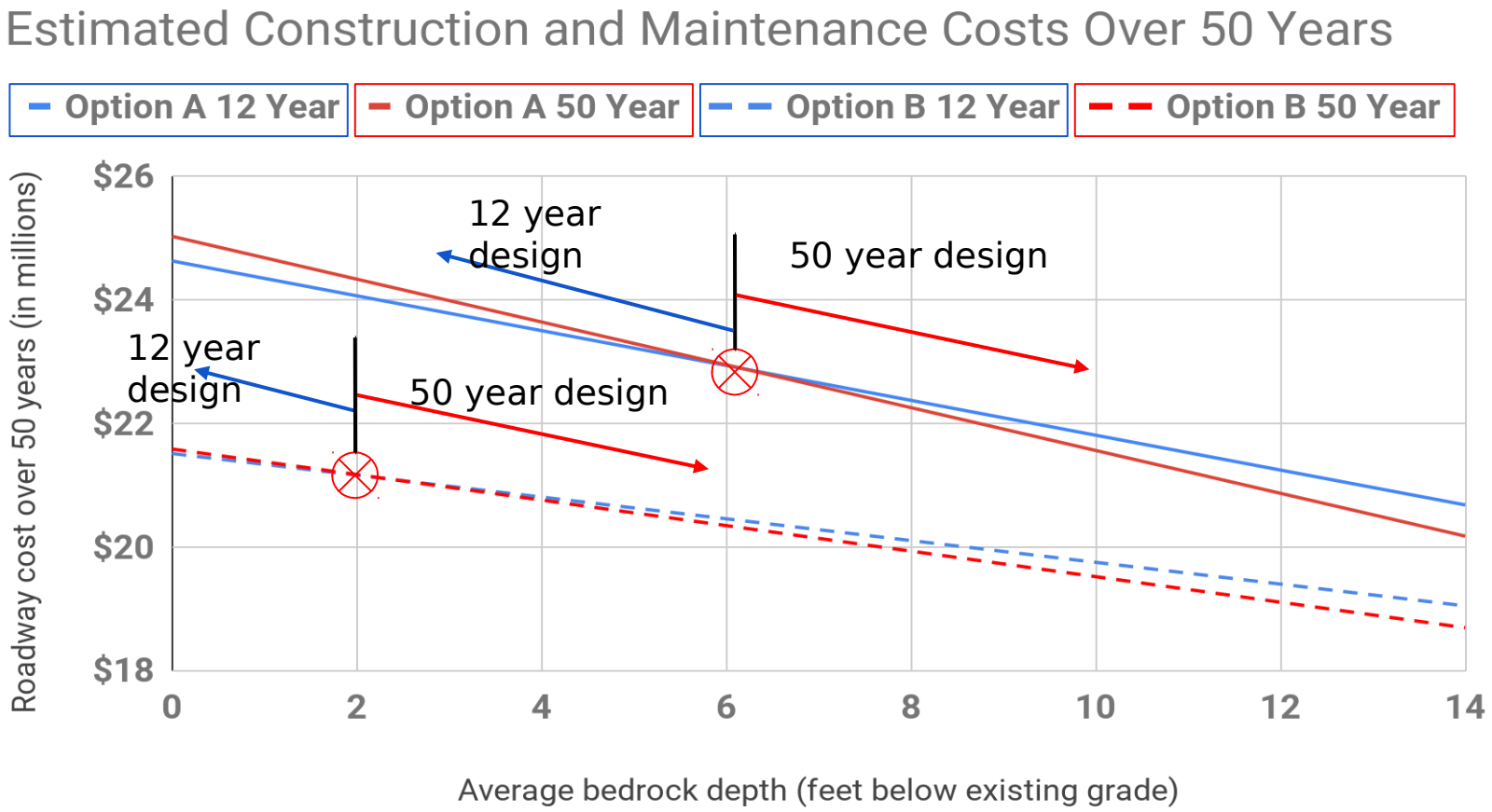
Major results:

- Based on MaineDOT bid pricing

12 Year Design	Low	High	Maintenance
Option A	$ 4,000,000	$ 8,000,000	$ 194,000
Bike Lane	$ 530,000	$ 940,000	$ 100,000
Sidewalk	$ 140,000	$ 670,000	$ 45,000
Option B	$ 2,500,000	$ 5,000,000	$ 174,000

50 Year Design	Low	High	Maintenance
Option A	$ 4,700,000	$ 9,500,000	$ 185,000
Bike Lane	$ 1,000,000	$ 1,200,000	$ 100,000
Sidewalk	$ 140,000	$ 670,000	$ 45,000
Option B	$ 3,000,000	$ 5,900,000	$ 170,000

Conclusions



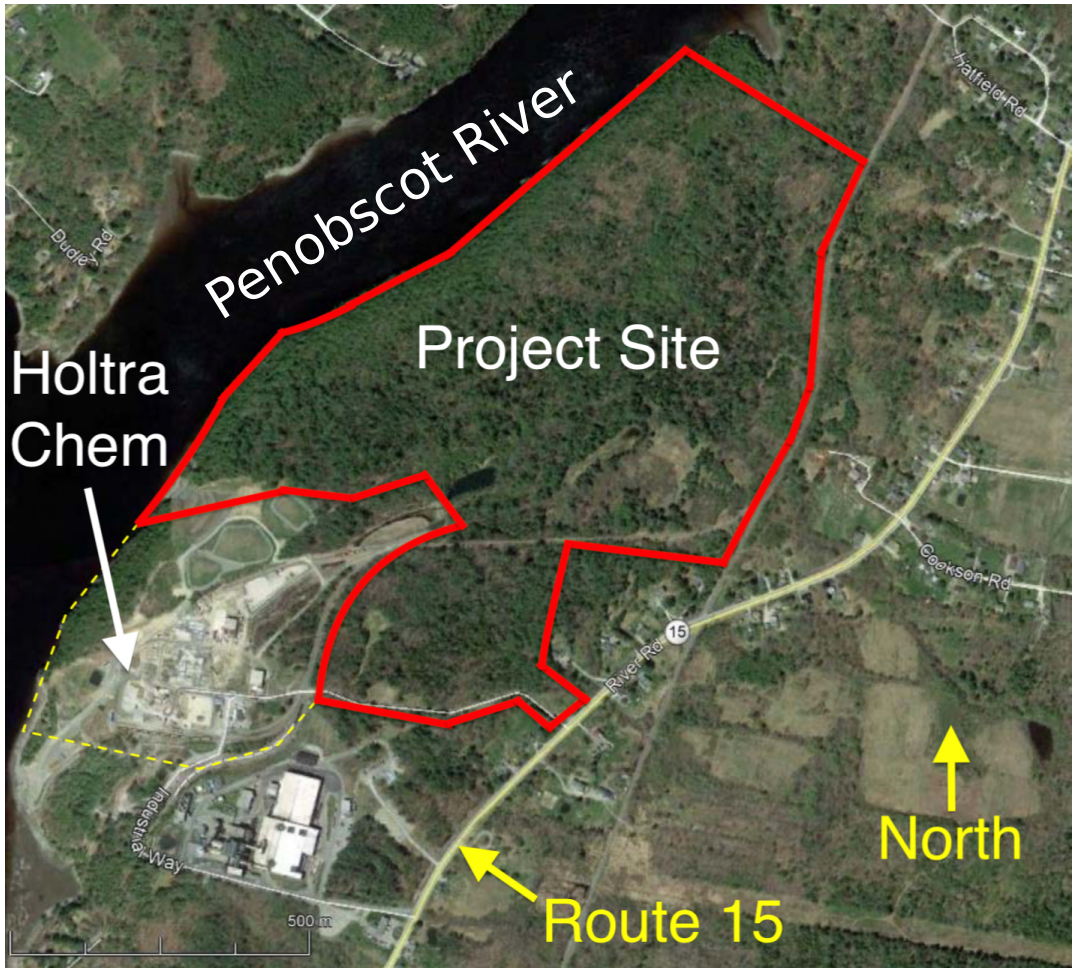
Project Summary

Presented by James Costigan

Summary of Project

- Engineering disciplines
- Site restrictions
- Min. cost $2.5 million
- Max. cost $11.4 million

**Information provided by JAMBS SE should not substitute for or replace the services of a design professional practicing in the areas of engineering or architecture



Google maps edited by JAMBS SE

Acknowledgements

Our Client: Town of Orrington

Project Representative: Mr. Dan Wellington

Capstone Professors: Aria, Edwin, Elizabeth, Luke, and Melissa

UMaine Faculty and Staff

Questions ?

For additional information contact Brody Campbell (PM):
Email: brody.campbell@maine.edu